

CALIFORNIA DEPARTMENT OF TRANSPORTATION

STUDY GUIDE

FOR THE

TRANSPORTATION ENGINEERING

TECHNICIAN EXAMINATION

REVISED 10/01



INTRODUCTION

The purpose of this study guide is to help you prepare for the Transportation Engineering Technician (TET) written examination. The written examination consists of the following four sections:

1. Mathematical Calculations: mathematical skills in the areas of algebraic, geometric, and trigonometric problem solving
2. Reading Comprehension: skill to read and apply written information
3. Writing Skills: skill to communicate in writing
4. Reading and Interpreting Maps and Drawings: skill to read and interpret maps and drawings

You must receive a passing score on each of the sections in order to pass this examination and continue in the hiring process.

There is no penalty for guessing or choosing an incorrect answer. The examination is scored on the basis of the number of items answered correctly. If you are not sure of an answer, it is best to guess what the answer might be, rather than leaving the question unanswered. Do not spend an unnecessary amount of time attempting to answer any one question. Each of the four sections is timed separately.

This study guide is meant to give you an idea of the types of questions that will be on the actual TET examination. It is NOT meant to be inclusive of all material covered in the examination. The exact questions contained in this study guide will not appear on the actual examination. You will not be permitted to use this study guide during the actual TET examination. You will be provided with a non-programmable calculator for your use during the examination.

The examination was designed to measure knowledge, skills, and abilities required for successful job performance. The examination assesses the following:

Knowledge of:

- mathematical principles and concepts, including subtraction, multiplication, division, fractions, percentages, and proportions, to calculate and solve mathematical equations encountered in the course of completing engineering tasks and analyses
- standard weights and measures (e.g., feet, pounds, fluid ounces) to conceptualize and calculate various measurements, amounts, and quantitative data based upon a common frame of reference
- the metric system (e.g., meters, grams, liters) to conceptualize and calculate various measurements, amounts, and quantitative data based upon a common frame of reference and to convert values from standard weights and measures to metric equivalents

- algebraic formulas and concepts to perform calculations and compute for unknown values as required in solving engineering mathematical equations
 - syntax and spoken language rules for the English language to formulate proper sentences, speak in a correct and understandable manner to a variety of audiences, and understand the verbal communication of others speaking English
 - proper spelling, grammar, punctuation, and sentence structure to ensure that written materials prepared and those reviewed are complete, succinct, and free of writing errors
- Skill to:
- perform accurate mathematical calculations using basic mathematics, algebraic functions and concepts, and engineering principles
 - operate a standard calculator to compute various mathematical equations and problems using algebraic, geometric, and trigonometric calculations
 - read and understand maps and drawings to ensure appropriate and correct interpretation of information and data presented in this format
 - use the metric system and metric units of measure for data collection, measurement, calculation, and reporting
 - accurately convert units of standard weights and measures (e.g., feet, pounds, and fluid ounces) to metric units of measure (e.g., meters, grams, and liters)
 - read and comprehend a variety of reports, correspondence, and other prepared documents related to highway and bridge construction projects, industry standards, regulatory requirements, project plans and specifications, statistical data and engineering calculations
 - accurately convert metric units of measure (e.g., meters, grams, liters) to units of standard weights and measures (e.g., feet, pounds, fluid ounces)
- Ability to:
- understand and follow brief written instructions and directions for the completion of work tasks
 - understand and follow complex, detailed written instructions and directions for the completion of assigned work tasks

MATHEMATICAL CALCULATIONS

The following unit conversions and formulas will be provided to you on the examination. You will **NOT** need to memorize these tables for the examination, but you should familiarize yourself with their contents.

LENGTH	
Metric	Standard
1 millimeter (mm)	0.0394 inches (in)
1 meter (m)	1.0936 yards (yd)
1 kilometer (km)	0.6214 miles

Standard	Metric
1 foot (ft)	0.3048 meters (m)
1 yard (yd)	0.9144 meters (m)
1 mile	1.6093 kilometers (km)

AREA	
Metric	Standard
1 square m (m^2)	1.1960 square yd (yd^2)
1 square km (km^2)	0.3861 mile ²

Standard	Metric
1 square foot (ft^2)	0.0929 square meters (m^2)
1 square yard (yd^2)	0.8361 square meters (m^2)

VOLUME	
Metric	Standard
1 cubic meter (m^3)	1.3080 cubic yards (yd^3)

Standard	Metric
1 cubic foot (ft^3)	0.0283 cubic meters (m^3)

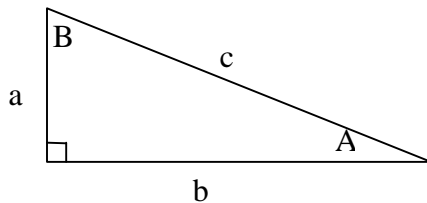
Geometry

AREA	
Circle	πr^2
Rectangle	lw
Square	s^2
Trapezoid	$\frac{1}{2} (w_1 + w_2) (h)$
Triangle	$\frac{1}{2} bh$

VOLUME	
Cone	$\frac{1}{3} \pi r^2 h$
Cube	s^3
Cylinder	$\pi r^2 h$
Rectangular Prism	lwh
Sphere	$\frac{4}{3} \pi r^3$

Symbol Legend	
π	Pi = 3.14
A	Area
b	Base
h	Height
l	Length
r	Radius
s	Side
w	Width

Trigonometry/Triangles



Pythagorean Theorem: $a^2 + b^2 = c^2$

SIN
$\sin A = a/c$
$\sin B = b/c$

COS
$\cos A = b/c$
$\cos B = a/c$

TAN
$\tan A = a/b$
$\tan B = b/a$

Legend	
a	Length of side of triangle
b	Length of side of triangle
c	Length of hypotenuse of triangle

The following are sample problems similar to those that appear on the TET examination. As in the actual examination, figures are not drawn to scale. These sample problems are meant to give you an understanding of the types of questions on the examination.

1. Add the following:

$$\frac{5}{6} + \frac{15}{11} =$$

- A. $\frac{10}{33}$
- B. $1 \frac{13}{132}$
- C. $1 \frac{3}{17}$
- D. $2 \frac{13}{66}$**

Solution:

Find a common denominator (i.e., 66).

$$[\frac{11}{11} (\frac{5}{6})] + [(\frac{6}{6}) (\frac{15}{11})] = \frac{55}{66} + \frac{90}{66}$$

Add the numerators.

$$55 + 90 = 145$$

Place the numerator over the common denominator.

$$\frac{145}{66}$$

Reduce the fraction if necessary.

$$145 \div 66 = 2 \text{ with a remainder of } 13 \rightarrow \mathbf{2 \frac{13}{66}}$$

2. Multiply the following: $\frac{2}{3}$, $\frac{1}{7}$, and $\frac{3}{8}$

- A. $\frac{1}{168}$
- B. $\frac{1}{28}$**
- C. $\frac{6}{28}$
- D. $\frac{6}{18}$

Solution:

Multiply the numerators.

$$2 \times 1 \times 3 = 6$$

Multiply the denominators.

$$3 \times 7 \times 8 = 168$$

Reduce the fraction if necessary.

$$168 \div 6 = 28 \rightarrow \mathbf{\frac{1}{28}}$$

3. A contract requires an initial payment of 36% the total contract amount. The total contract amount is \$74.2 million. How much is the initial payment?

- A. \$2.7 million
- B. \$26.7 million**
- C. \$74.6 million
- D. \$206.1 million

Solution:

Multiply the contract amount by 36%.

$$74.2 \text{ million} \times .36 = \mathbf{\$26.7 \text{ million}}$$

4. A backhoe excavates 92 cubic yards of gravel in 48 minutes. How many cubic yards of gravel can the backhoe excavate in 6 hours?
- A. 12 cubic yards
 - B. 188 cubic yards
 - C. 690 cubic yards**
 - D. 736 cubic yards

Solution:

Setup a ratio.

$$92 \text{ yd}^3 / 48 \text{ min} = x / 360 \text{ minutes}$$

Solve for x.

$$48x = 92(360)$$

$$48x = 33120$$

$$x = 33120 \div 48$$

$$x = \mathbf{690 \text{ cubic yards}}$$

5. Three earthmovers excavated 926 cubic yards, 1002 cubic yards, and 978 cubic yards of soil each. What is the average amount of the soil the earthmovers excavated?
- A. 290.60 cubic yards
 - B. 950.00 cubic yards
 - C. 968.67 cubic yards**
 - D. 8,718.00 cubic yards

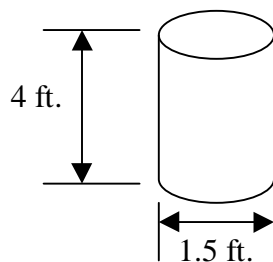
Solution:

Calculate the average.

$$\text{Add the values: } 926 + 1002 + 978 = 2906 \text{ cubic yards}$$

$$\text{Divide by the number of values: } 2906 \div 3 = \mathbf{968.67 \text{ cubic yards}}$$

6. What is the volume of this cylinder in cubic meters?



- A. 0.20**
- B. 0.66
- C. 2.15
- D. 7.07

Solution:

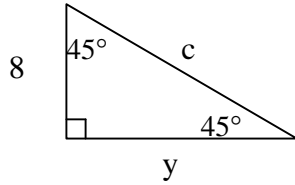
Calculate the volume in cubic feet.

$$\pi r^2 h = 3.14 (.75 \text{ ft.})^2 (4 \text{ ft.}) = 7.065 \text{ ft}^3$$

Convert cubic feet to cubic meters.

$$7.065 \text{ ft}^3 (.0283 \text{ m}^3 / 1 \text{ ft}^3) = \mathbf{0.20 \text{ m}^3}$$

7. Using the illustration below, what is the length of y?



Solution:

The sides of a 45° 45° 90° triangle are equal. Therefore y is **8**.

- ❖ If you need additional practice, you may wish to consult standard trigonometry, algebra, or geometry textbooks.

READING COMPREHENSION

The following are sample problems similar to those that appear on the TET examination. These sample problems are meant to give you an understanding of the types of questions on the examination.

Use the information in the following passage to answer questions 1 and 2.

Working near Vehicular Traffic

Whenever employees are directed to work on a highway, freeway, or city street the work should be planned, organized, and scheduled to minimize exposure to moving vehicular traffic.

Supervisors should instruct employees to perform their work by facing oncoming traffic, and not to work with their backs to traffic. Employees should always attempt to face traffic because it gives them an opportunity to see and hear approaching vehicles and, if necessary, take appropriate evasive action and/or to warn other employees if an errant vehicle enters the work zone.

1. According to the above passage, why should employees perform their work while facing oncoming traffic?
 - A. It allows them to see and hear approaching vehicles.**
 - B. It allows them to take license plate numbers of speeding vehicles.
 - C. It allows them to warn speeding drivers to slow down.
 - D. It allows them to work with their backs to the traffic.

*According to the passage, A is the correct answer.

2. According to the above passage, which of the following times would be BEST to schedule employees to work on a highway?
 - A. During morning rush-hour
 - B. During evening rush-hour
 - C. Before morning rush-hour**
 - D. During a high-traffic holiday

*According to the passage, C is the correct answer.

Use the information in the following table to answer questions 3 and 4.

Falsework Span & Depth Requirements for Freeways

Minimum Normal Width of Traffic Opening			Depth of Superstructure			
			Up to 1.85 m	Up to 2.45 m	Up to 3.05 m	Up to 3.65 m
Opening Width Provides for	Resulting Falsework Normal Span*	Minimum Falsework Depth				
7.5 m	1 lane + 2.4 m & 1.5 m shoulders	10 m	570 mm	635 mm	635 mm	825 mm
11.1 m	2 lane + 2.4 m & 1.5 m shoulders	13.6 m	840 mm	900 mm	915 mm	990 mm
14.7 m	3 lane + 2.4 m & 1.5 m shoulders	17.2 m	990 mm	1005 mm	1005 mm	990 mm
18.3 m	4 lane + 2.4 m & 1.5 m shoulders	20.8 m	1040 mm	1040 mm	1090 mm	1105 mm

*Includes 2.5 m for 2 temporary K-rails and deflection space.

3. According to the above table, what is the minimum normal width of traffic opening when spanning a 3 lane freeway?
- 7.5 m
 - 14.7 m**
 - 17.2 m
 - 18.3 m

*According to the table, B is the correct answer.

4. According to the above table, in which of the following instances would a 1005 mm minimum falsework depth be required?
- Spanning a 3-lane freeway with a 2.45 m depth of superstructure**
 - Spanning a 3-lane freeway with a 3.65 m depth of superstructure
 - Spanning a 4-lane freeway with a 2.45 m depth of superstructure
 - Spanning a 4-lane freeway with a 3.65 m depth of superstructure

*According to the table, A is the correct answer.

- ❖ If you need additional practice, you may wish to consult a General Educational Development (GED) study guide.

WRITING SKILLS

The following are sample problems similar to those that appear on the TET examination. These sample problems are meant to give you an understanding of the types of questions on the examination.

1. Which of the following sequences arranges these four sentences into the most effective and logical paragraph?
 1. Where the change in horizontal alignment at a grade summit is moderate, a pleasing appearance may be attained by making the vertical curve overlap the horizontal curve.
 2. A proper balance between curvature and grades should be sought.
 3. This reduces the number of sight restrictions on the project, makes changes in profile less apparent, particularly in rolling country, and results in a pleasing appearance.
 4. When possible, vertical curves should be superimposed on horizontal curves.
 - A. 3, 2, 4, 1
 - B. 2, 4, 3, 1**
 - C. 1, 4, 3, 2
 - D. 4, 1, 3, 2

For items 2 through 4, choose the answer which correctly completes each sentence.

2. Suggestions for research studies _____ be submitted to OPPD for consideration by the Pavement Design and Rehabilitation Committee which _____ chaired by the Structural Section and Design Standards Specialist in OPPD.
 - A. can; is
 - B. can; are
 - C. may; is**
 - D. may; are

*C is the correct answer.

3. In flat terrain, the elevation of the grade line _____ often controlled by drainage _____.
 - A. is; consideration
 - B. is; considerations**
 - C. are; consideration
 - D. are; considerations

*B is the correct answer

4. Estimating future truck traffic on ramps is more difficult _____ on through traffic lanes.
- A. then
 - B. than**
 - C. then is
 - D. than is

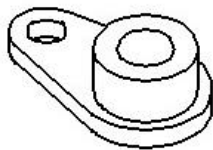
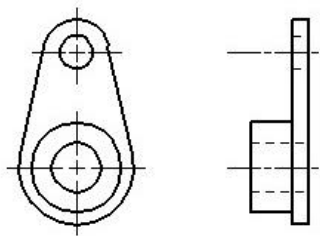
*B is the correct answer.

- ❖ If you need additional practice, you may wish to consult grammar and writing reference guides or textbooks (e.g., *Gregg Reference Manual*).

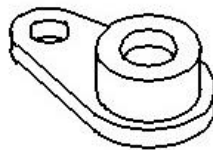
READING AND INTERPRETING MAPS AND DRAWINGS

The following are sample problems similar to those that appear on the TET examination. These sample problems are meant to give you an understanding of the types of questions on the examination.

1. Which of the following isometric drawings corresponds to the top and right side views of the shape shown below?



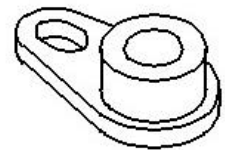
A



B

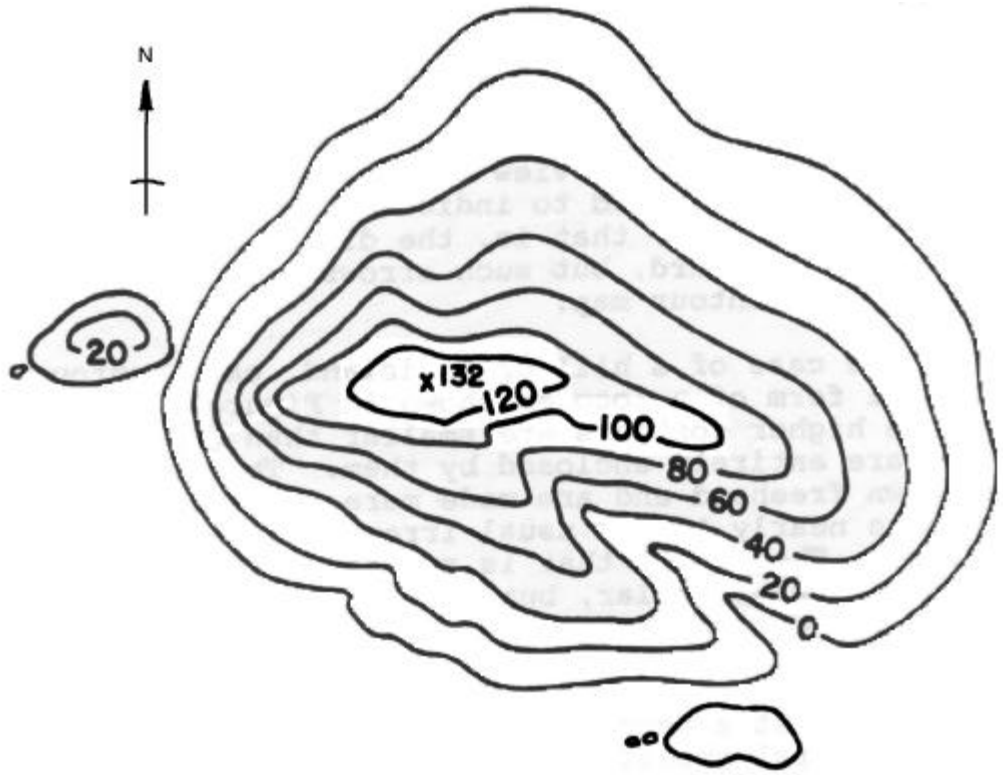


C



D

***A is the correct answer**



2. What is the contour interval of the contour map depicted above?

- A. 10 units
- B. 15 units
- C. 20 units**
- D. 25 units

***C is the correct answer**

3. According to the layout sheet on the following page, what is the radius of curve 7?

- A. 53.34
- B. 91.44
- C. 121.92
- D. 152.40**

***D is the correct answer**

4. According to the layout sheet on the following page, at what location will the place dike (type E) begin?

- A. +27.6**
- B. +73.6
- C. +80.0
- D. +95.0

***A is the correct answer**

5. According to the marker drawings on the following page, which of the following describe a Type K-2 object marker?
- A. Round flexible post surface mount
 - B. Flexible post with vertical orientation of sheeting**
 - C. Flexible post with horizontal orientation of sheeting
 - D. Round flexible post with vertical orientation of sheeting

***B is the correct answer**

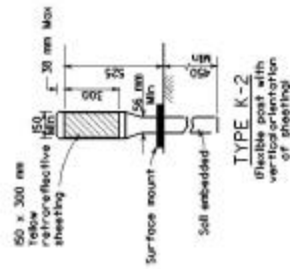
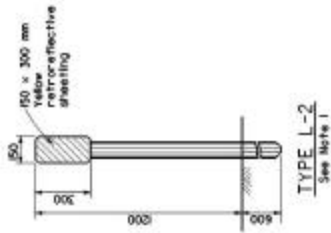
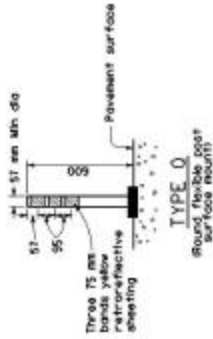
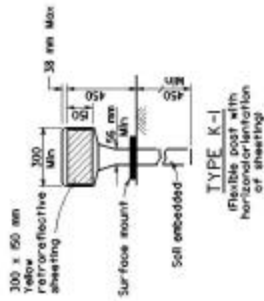
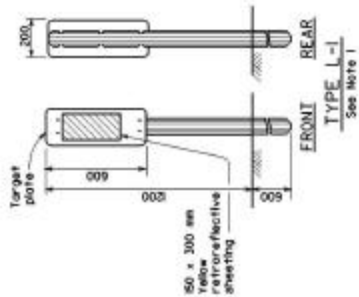
6. According to the marker drawings on the following page, what is the width of the target plate on Type L-1 object marker?
- A. 57 mm
 - B. 150 mm
 - C. 200 mm**
 - D. 300 mm

***C is the correct answer**

- ❖ If you need additional practice, you may wish to consult introductory drafting or surveying reference guides or textbooks (e.g., *Schaum Outline Series*).



July 1, 1999
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NOTE
 L See Standard Plan A73B for metal post details and additional markers.

STATE OF CALIFORNIA
 DEPARTMENT OF TRANSPORTATION
OBJECT MARKERS
 NO SCALE
 ALL DIMENSIONS ARE IN
 MILLIMETERS UNLESS OTHERWISE SHOWN

A73A